Culturing Microorganisms 2

Q:1(a) Microorganisms can be grown in Petri dishes containing nutrient agar. The Petri dish and nutrient agar must be sterilised before use.

Which method is used to sterilise the Petri dish and nutrient agar?

Tick (☒) one box.

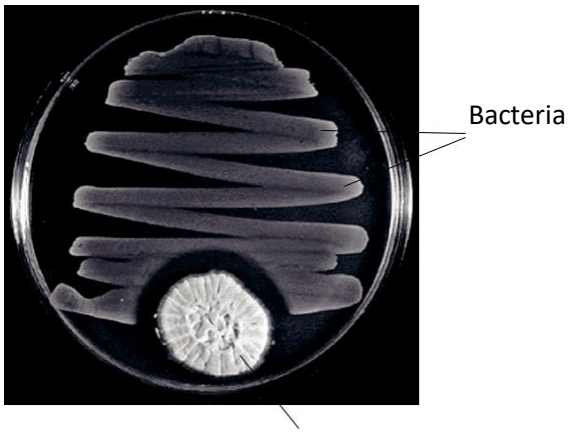
Heat at 120 °C for 30 minutes ☐

Pass through a Bunsen burner flame ☐

Place in an incubator at 25 °C for one day ☐

(1 mark)

(b) The photograph shows Penicillium mould and one species of bacterium growing together on nutrient agar in a Petri dish.



The Penicillium mould produces an antibiotic. How can you tell this from the photograph?

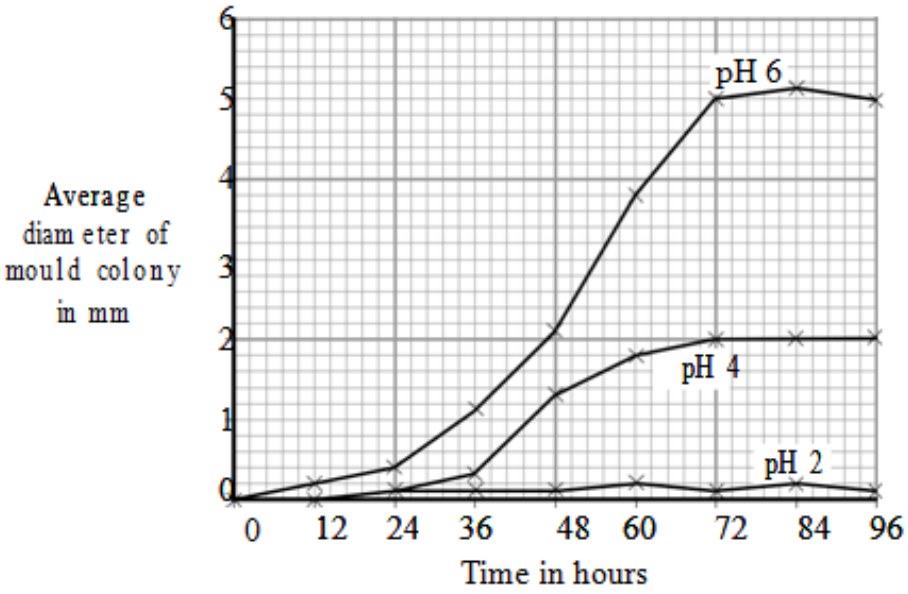
_____

_____

(1 mark)

(c) A student investigated the effect of pH on the growth of Penicillium. He used three Petri dishes containing nutrient agar.

- The pH of the nutrient agar in the three Petri dishes was 2, 4 and 6 respectively.
- He inoculated each Petri dish with the same amount of
- Penicillium
- mould.
- Every 12 hours, he measured the diameter of five Penicillium colonies in each dish.
- From these measurements, he calculated the average diameter of the five colonies in each dish.



(c)(i) Complete the sentence.

Calculating the average diameter of five colonies from each dish made the results

more _____

(1 mark)

(c)(ii) At which pH did the mould grow best? _____

(1mark)

(c)(iii) What was the maximum average diameter of the mould colony at pH 4?

_____ mm

(1 mark

(c)(iv) During which 12-hour period was growth fastest at pH 6?

From _____ to _____ hours.

(1 mark)

(d) pH is only one factor which affects the growth of Penicillium mould.

When Penicillium is grown in an industrial fermenter, other factors also need to be controlled.

Give two of these other factors.

1_____

2_____

(2 marks)

Q:2 (a) In industry, microorganisms are grown in fermenters to make useful products.

Name one useful product that can be made using microorganisms grown in a fermenter.

_____

(1 mark)

(b) Scientists grew one species of bacterium in a fermenter.

The scientists added glucose and other nutrients to the culture medium in the fermenter.

To study the growth of the bacteria, the scientists removed a 1 cm3 sample of the culture medium from the fermenter once every 5 hours. They added a measured volume of water to dilute the sample by a known amount.

The scientists used two different methods to find the number of bacteria in each sample.

Method A

The scientists:

□□added 0.1 cm3□of the diluted culture to a Petri dish

□□poured molten agar into the Petri dish and swirled the dish to mix the contents□□□placed the Petri dish in an incubator at 35 °C for 24 hours

□□counted the number of colonies of bacteria that had grown in the Petri dish.

Method B

The scientists:

□□put some of the diluted sample into a special counting chamber on a microscope□□□counted the number of bacteria found in a small volume of the diluted culture.

(b) (i) In each method, the scientists diluted the samples that they removed from the fermenter.

Why did they need to do this?

_____

_____

(1 mark)

(b) (ii) In Method A, the scientists counted colonies of bacteria that had grown in a Petri dish. Explain how counting colonies helped the scientists to find the number of bacteria in a sample.

_____

_____

_____

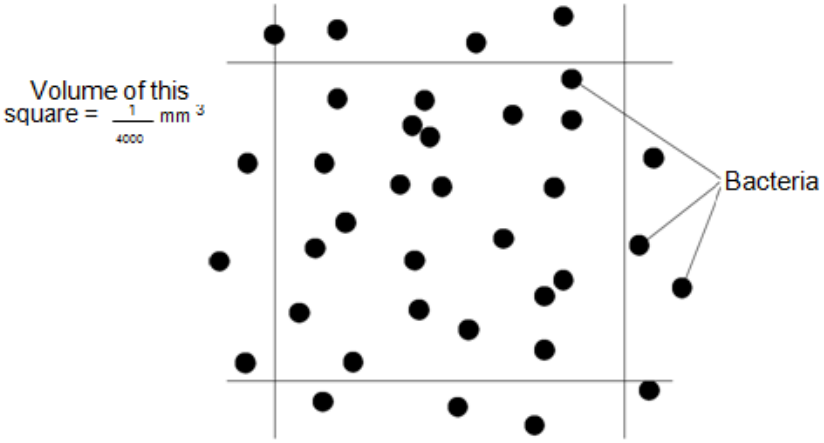
_____

(2 marks)

(c) The scientists wanted to find the number of bacteria in a sample of culture medium by using Method B.

The sample of culture medium was diluted to 1/100 of its original concentration.

The diagram shows part of the counting chamber as seen under a microscope.



Complete the following calculations to find how many bacteria there were in 1 mm3 of the undiluted sample of culture medium.

Use information from the diagram.

Number of bacteria in $\frac{1}{4000}$ mm 3 of diluted culture medium = _____

Number of bacteria in 1 mm3 of diluted culture medium = _____

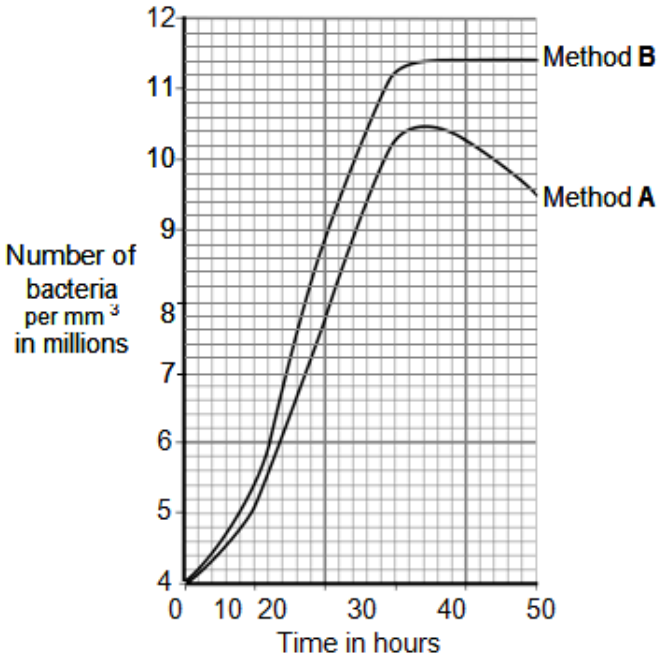
Number of bacteria in 1 mm3 of undiluted culture medium = _____

(2 marks)

(d) The scientists grew the bacteria for 50 hours.

Graph 1 shows the scientists' results.

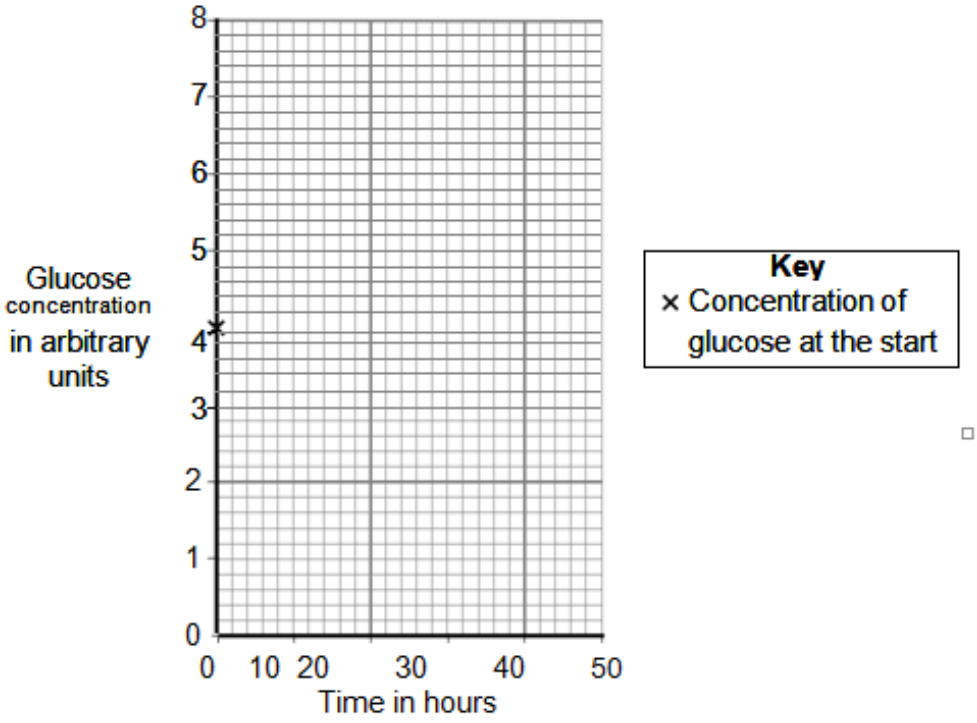
Graph 1



Graph 2 is not complete.

The concentration of glucose in the fermenter at the start of the investigation was 4 units.

Graph 2



(d) (i) On Graph 2, draw a line to show how the glucose concentration would change over the 50 hours of the investigation.

(2 marks)

(d) (ii) Explain the shape of the growth curve that was obtained using Method A. Use information from your answer to part (d)(i).

_____

_____

_____

_____

_____

_____

(3 marks)

(d) (iii) Why did Method B give higher values for the number of bacteria than Method A?

_____

_____

(1 mark)

Q:3 A student is given a tube containing a liquid nutrient medium. The medium contains one type of bacterium.

(a) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The student is told to grow some of the bacteria on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

You should explain the reasons for each of the steps you describe.

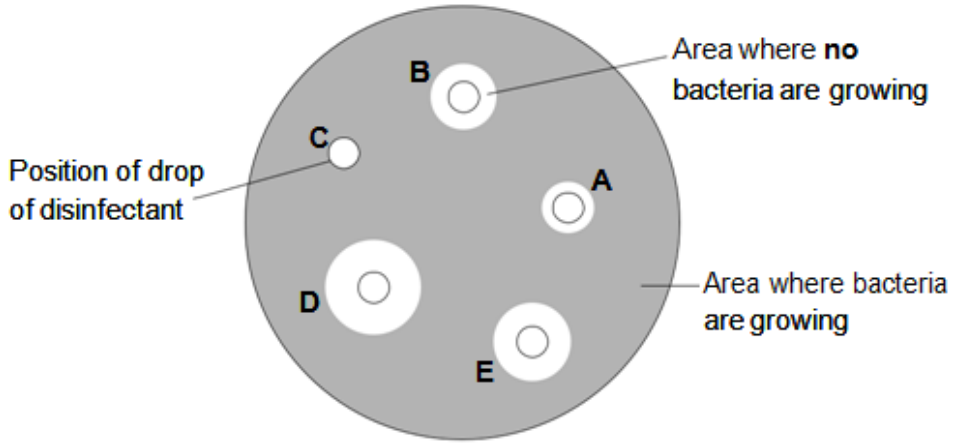
_____

_____

(6 marks)

(b) After the culture had been prepared, the student added one drop of each of five disinfectants, A, B, C, D and E, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



(b) (i) There are areas on the agar jelly where no bacteria are growing.

Why?

_____

_____

(1 mark)

(b) (ii) The student concluded that disinfectant D would be the best for using around the home. Give one reason why the student might be correct.

_____

_____

_____

Give one reason why the student might not be correct.

_____

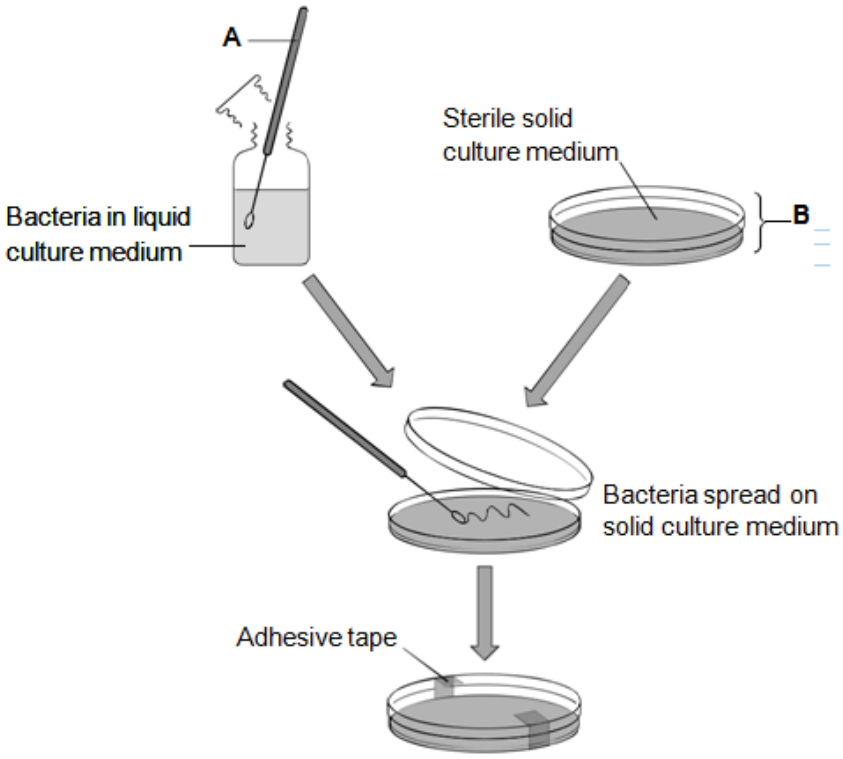
_____

_____

(2 marks)

Q:4 Figure 4 shows a method used to grow pure cultures of a bacterium.

Figure 4



(a) Name apparatus A and apparatus B.

Apparatus A _____

Apparatus B _____

[2 marks]

(b) (i) Why should apparatus A and apparatus B be sterilised before they are used?

_____

_____

[1 mark]

(b) (ii) How should apparatus A be sterilised?

Tick (☒) one box.

Using enzymes ☐

Using a flame ☐

In an incubator ☐

[1 mark]

(b) (iii) Adhesive tape is used to secure the lid on apparatus B.

Give one reason why the lid of apparatus B should be securely taped in place.

_____

_____

[1 mark]

(c) What is the maximum temperature that should be used in schools to grow the bacteria in apparatus B?

Draw a ring around the correct answer.

10 °C 25 °C 50 °C

[1 mark]

TOTAL MARKS=35